



*Sustainable Universities &
Colleges Symposium
October 28, 2011*

Biomass Energy: Opportunities for Sustainability, Service, & Teaching

Fred Iutzi, MS

Illinois Institute for Rural Affairs



www.IIRA.org



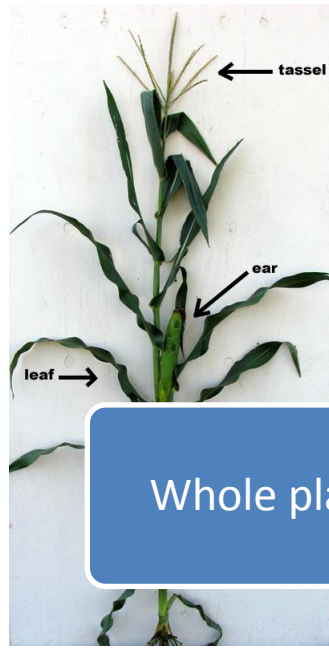
**WESTERN
ILLINOIS
UNIVERSITY**

Illinois Institute for Rural Affairs

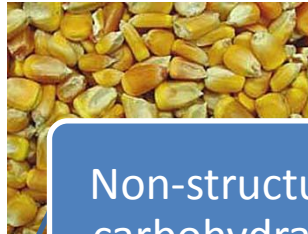
- Founded by Executive Order in 1989 as “State clearinghouse for rural development data and initiatives”
- Housed at Western Illinois University in Macomb
- Value-Added Sustainable Development Center leads ag & renewable energy efforts



What is biomass?



Whole plant

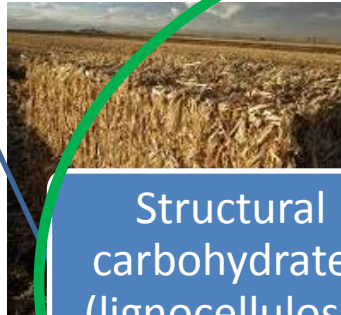


Non-structural
carbohydrates

Sugars

Starches

Oils

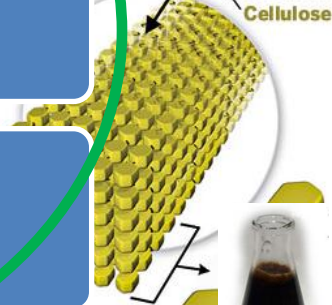
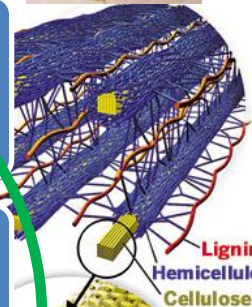


Structural
carbohydrates
(lignocellulose)

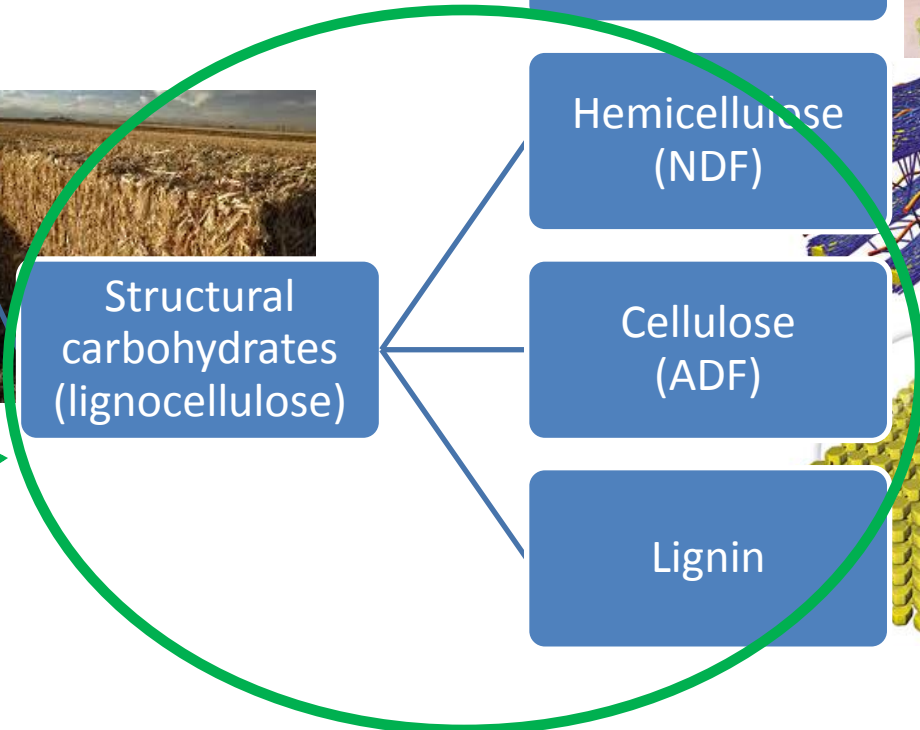
Hemicellulose
(NDF)

Cellulose
(ADF)

Lignin

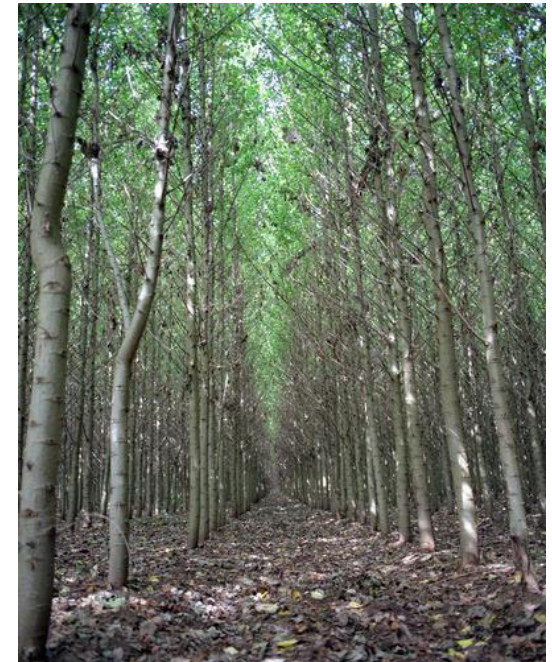


My definition
of "biomass"



What are the major biomass feedstocks?

- Key platforms: crop residues, perennial grasses, and woody material.



Conservation value of perennials

326

ISENHART ET AL.



324

ISENHART ET AL.

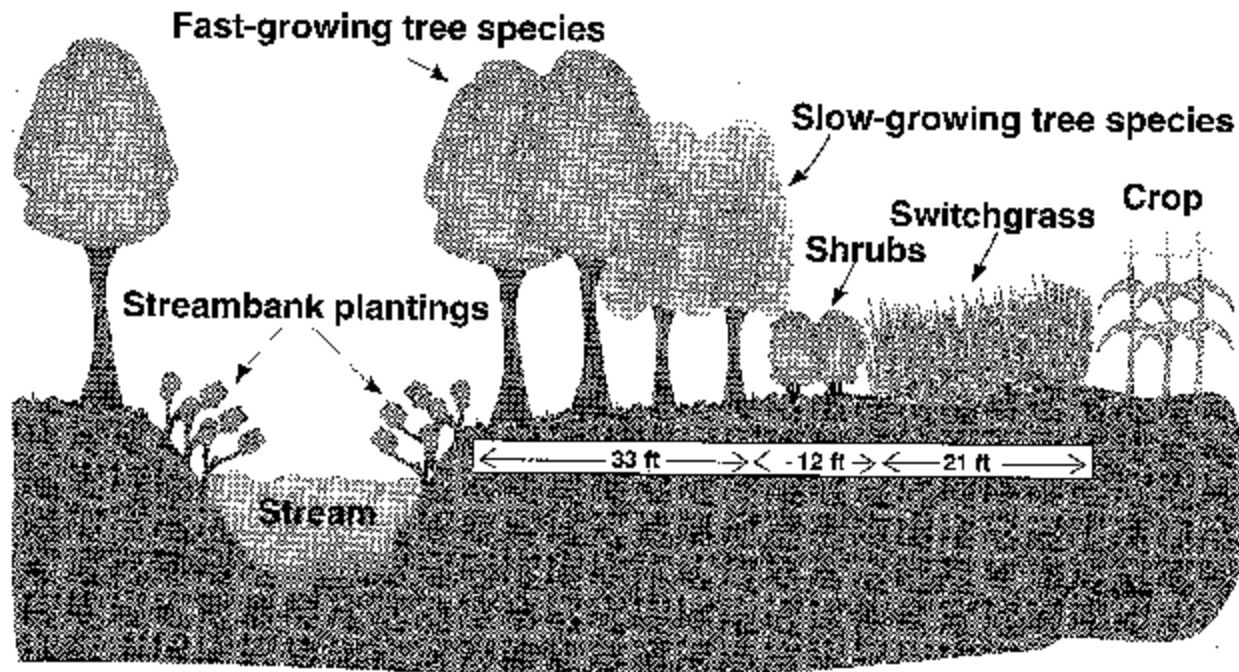
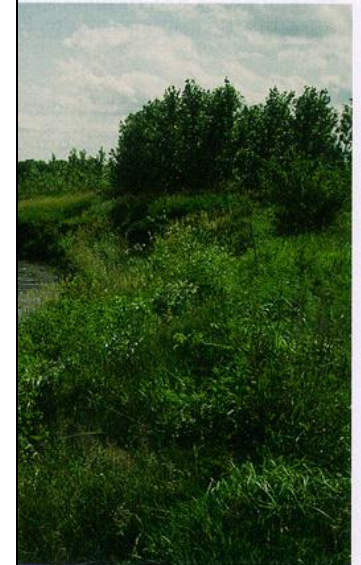


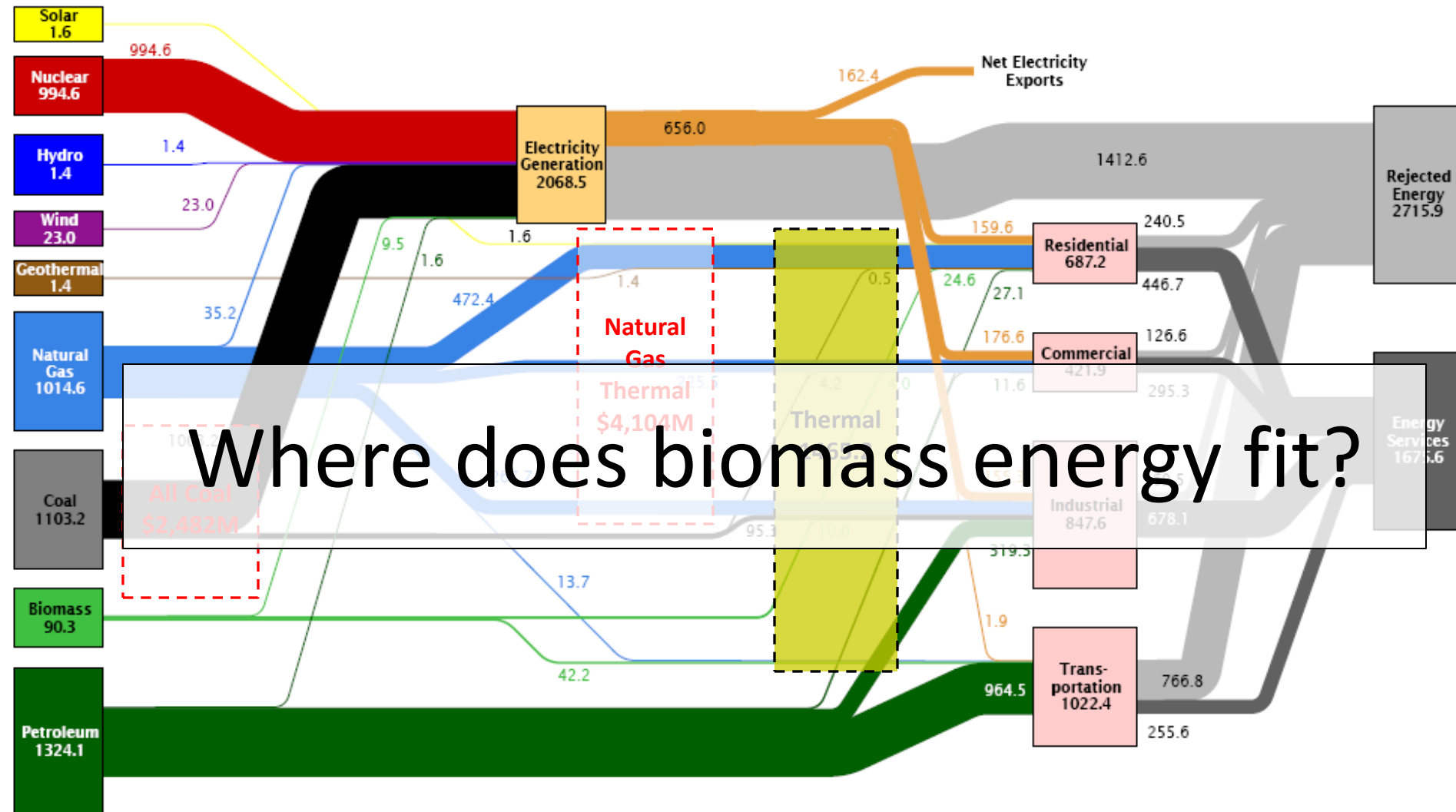
FIGURE 19.2.—The multispecies riparian buffer strip model includes tree rows closest to the stream, next to the trees, shrubs, and then a strip of switchgrass adjacent to the cropland.



Top photograph shows site in March. The right side of the stream had been cleared. Bottom photograph shows same site in June, showing dramatic improvement in the condition of the streambanks after only five seasons of riparian management.

Top photograph shows site in March. The right side of the stream had been cleared. Bottom photograph shows same site in June, showing dramatic improvement in the condition of the streambanks after only five seasons of riparian management.

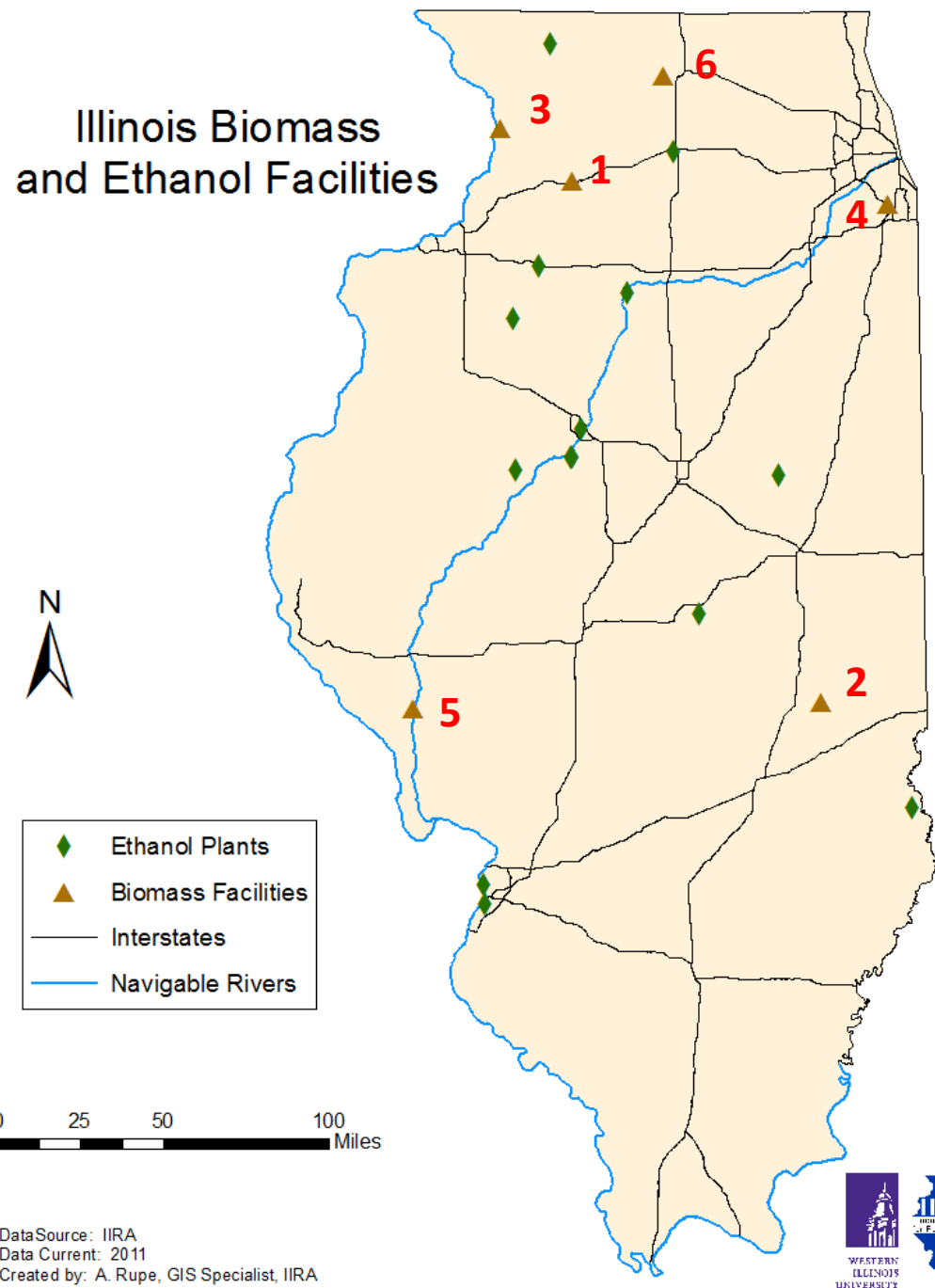
Estimated Illinois Energy Use In 2008 ~4554.0 Trillion BTU



Source: LLNL 2010. Data is based on DOE/EIA-0214(2008), June 2010. If this information or a reproduction of it is used, credit must be given to the Lawrence Livermore National Laboratory and the Department of Energy, under whose auspices the work was performed. Distributed electricity represents only retail electricity sales and does not include self-generation. EIA reports flows for non-thermal resources (i.e., hydro, wind and solar) in BTU-equivalent values by assuming a typical fossil fuel plant "heat rate." The efficiency of electricity production is calculated as the total retail electricity delivered divided by the primary energy input into electricity generation. Interstate and international electricity trade are lumped into net imports or exports and are calculated using a system-wide generation efficiency. End use efficiency is estimated as 65% for the residential, 70% for the commercial, 80% for the industrial sector, and as 25% for the transportation sector. Totals may not equal sum of components due to independent rounding. LLNL-MI-410527

Biomass heat & power in IL

1. BioPro Rock Falls, 25 MW
2. EIU REC, heat
3. Jo-Carroll Energy, 20 MW
4. Robbins Comm. Power, 50 MW
5. Prairie Power, 22 MW 10% co-fire
6. Freedom Field, heat (small)



USDOE Integrated Biorefineries Program

Biomass Program *Integrated Biorefinery Platform*

IBR PROJECTS

Click on the project locations to see more information and locations are approximate



<http://www.eere.energy.gov/biomass/>



Biomass on campus

EIU Renewable Energy Center



EIU

© 2008 international architects atelier

eastern illinois university - renewable energy center

north east view

The image shows the exterior wall of a building made of light-colored stone blocks. Red, three-dimensional lettering is mounted on the wall. The top line reads "MOUNT WACHUSETT COMMUNITY COLLEGE" and the bottom line reads "BIOMASS POWER PLANT". In the upper right corner, two red industrial smokestacks are visible against a clear blue sky.

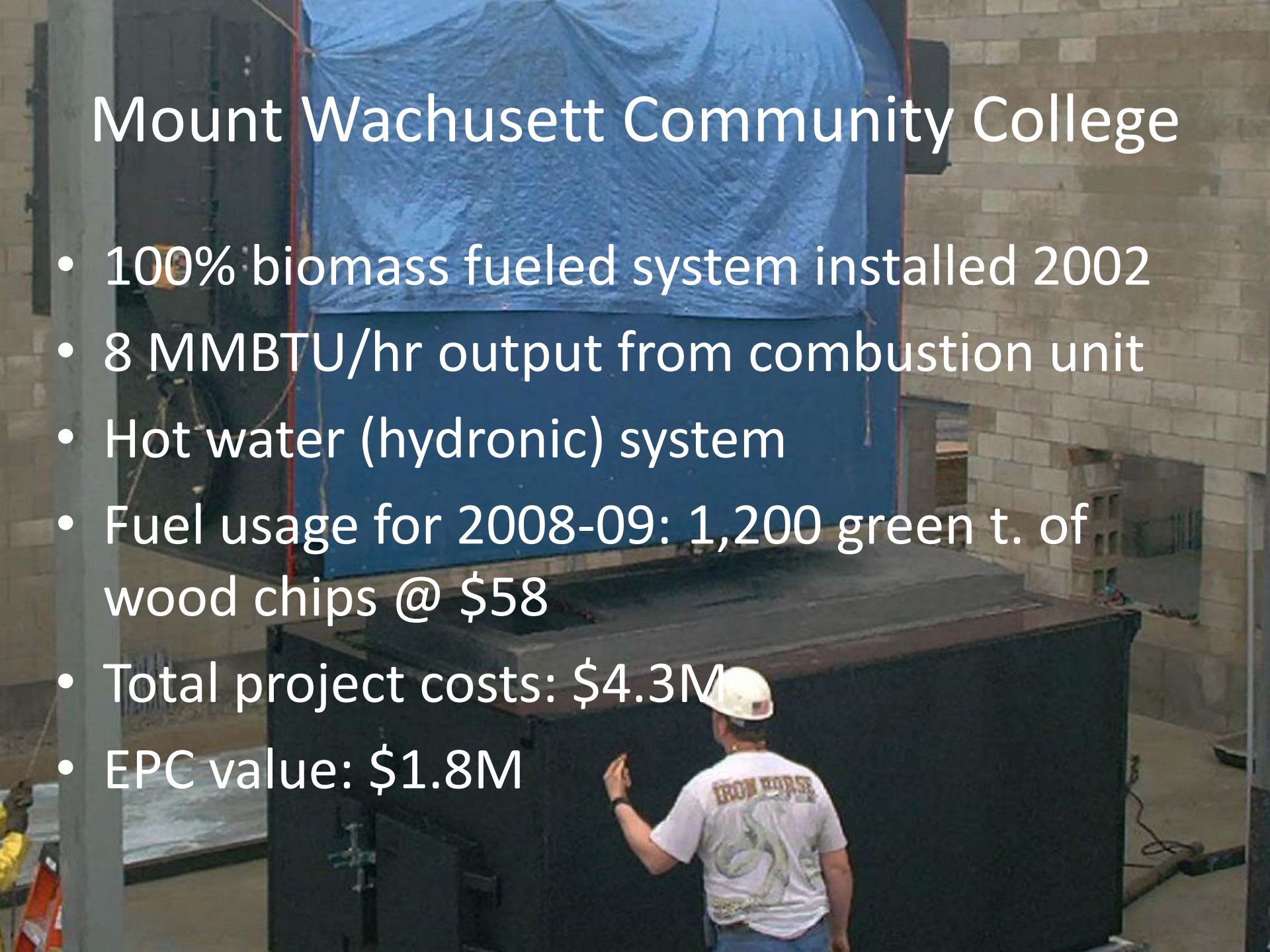
MOUNT WACHUSETT COMMUNITY COLLEGE BIOMASS POWER PLANT

MWCC

- MWCC located in Gardner, MA
- 450,000 ft² building complex to heat
- Previous system: electrical resistance heaters
- Feasibility study determined biomass competitive to fuel oil or natural gas
- Opportunity to leverage Energy Performance Contracting

Mount Wachusett Community College

- 100% biomass fueled system installed 2002
- 8 MMBTU/hr output from combustion unit
- Hot water (hydronic) system
- Fuel usage for 2008-09: 1,200 green t. of wood chips @ \$58
- Total project costs: \$4.3M
- EPC value: \$1.8M

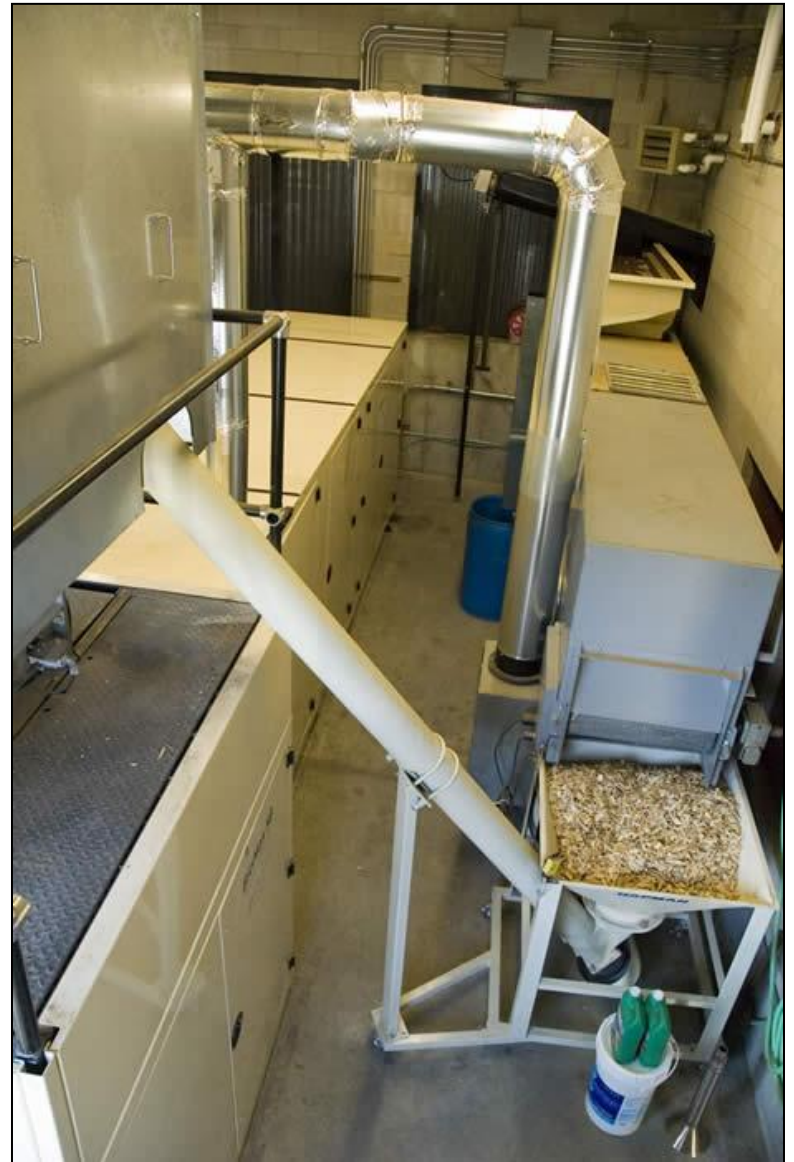


Mount Wachusett Community College

- Additional project:
50kW biomass
combined heat &
power (CHP) unit

MWCC website:

<http://mwcc.edu/renewable/>



A note on feedstock prices

- Natural gas is currently ~\$4/MMBTU.
- Grass biomass contains ~16 MMBTU/t DM.
- ...so a natural gas user can pay ~\$62/t DM for grass biomass and stay cost neutral.
- This doesn't account for costs of converting to biomass, storage, processing, etc....
- ...but also doesn't account for the sustainability and institutional image benefits of biomass.

A photograph of a field with tall green grass and several corn plants. The corn plants are in various stages of growth, with some showing yellowing leaves. In the background, there are utility poles and a clear blue sky. The text "Opportunities for outreach" is overlaid in the center of the image.

Opportunities for outreach

USDA BCAP: Biomass Crop Assistance Program



FACT SHEET

UNITED STATES DEPARTMENT OF AGRICULTURE
FARM SERVICE AGENCY

October 2010

Biomass Crop Assistance Program (BCAP)

Overview

The Biomass Crop Assistance Program (BCAP), created in the 2008 Farm Bill, is a primary component of the domestic agriculture, energy, and environmental strategy to reduce U.S. reliance on foreign oil, improve domestic energy security, reduce carbon pollution, and spur rural economic development and job creation. BCAP provides incentives to interested farmers, ranchers and forest landowners for the establishment and cultivation of biomass crops for heat, power, bio-based products and biofuels.

BCAP will address a classic chicken-and-egg challenge: if commercial-scale biomass facilities are to have sufficient feedstocks, then an established, large-scale energy crop source must exist. Conversely, if profitable crop production is to occur, then a viable consumer base must exist to purchase the product.

With the enactment of the updated federal Renewable Fuels Standard, which requires 36 billion gallons of advanced biofuels in the national fuel supply by 2022, new crops must keep pace with these revised federal targets. Many bioenergy crops need several years to become established. Many bioenergy facilities need several years to reach commercial scale. BCAP serves as a catalyst to unite these multiple dynamics by reducing the financial risk for landowners who

- Crop producers and bioenergy producers will be able to team together to submit applications to USDA to be selected as a BCAP project area.

- If selected, crop producers will be eligible for reimbursements of up to 75 percent of the cost of establishing a bioenergy perennial crop. Producers also can receive up to 5 years of annual payments for grassy crops (annual or perennial), and up to 15 years of annual payments for woody crops (annual or perennial).

- Assistance for the collection, harvest, storage and transportation of biomass to biomass conversion facilities will be available for 2 years, per producer, in the form of a matching payment for up to \$45 per ton of the delivery cost to the facility.

Highlights

• Expenditures

During the Notice of Funding Availability (NOFA) period, \$250 million was expended during roughly one quarter year of BCAP matching payments. Refinements to the BCAP final rule has the BCAP cost-benefit analysis estimating that total expenditures over 15 years will be \$461 million.

- Blue, White and Green-Colored Job Creation:

impact from implementation to be an estimated \$88.5 billion in economic activity.

• New Energy Crop Feedstocks

BCAP will reduce the financial risk of producers who support emerging biofuels markets. Crops include, but are not limited to, switchgrass, miscanthus, fast-growing woody poplar, jatropha, algae, energy cane, and pongamia.

• Enhanced stewardship and conservation measures

1. Under BCAP, biomass must be certified to have been collected and harvested only with an approved conservation, forest stewardship, or similar plan to protect soil and water quality and preserve land productivity into the future.
2. Harvesting must occur with an approved harvest plan.
3. BCAP project areas cannot occur on native sod.
4. All crop collection, harvesting, and transportation must be in strict accordance with invasive plant species protection.

• Protects existing markets

Eligible materials may not qualify for matching payments for BCAP purposes if USDA determines that in those distinct localities that the materials are used for pre-existing markets.

BCAP



FACT SHEET

UNITED STATES DEPARTMENT OF AGRICULTURE
FARM SERVICE AGENCY

October 2010

Biomass Crop Assistance Program (BCAP)

- Intended as flagship USDA biomass feedstock production incentive program.
- First fully implemented in FY11.
- Revolves around geographic “Project Areas”
- Establishment payments: up to 75% of cost of establishing a perennial biomass crop.
- Annual payments: Per-acre payments for

Overview

The Biomass Crop Assistance Program (BCAP), created in the 2008 Farm Bill, is a primary component of the domestic agricultural policy. It is designed to reduce U.S. reliance on foreign oil, improve domestic energy security, reduce carbon pollution, and encourage economic development. BCAP provides incentives to interested farmers, ranchers and forest landowners for the establishment and maintenance of biomass crops for energy and feedstocks.

BCAP will address a classic chicken-and-egg problem: without a viable consumer base, producers have sufficient feedstocks, then an established, large-scale energy processing facility must be built. If a viable consumer base must exist to purchase the product.

The energy industry's revised federal Renewable Fuels Standard, which requires 36 billion gallons of bioenergy production by 2022, is a challenge that producers must keep pace with these revised federal targets. Many bioenergy crops need several years to become established. Many bioenergy facilities need several years to reach commercial scale. BCAP serves as a catalyst to unite these multiple dynamics by reducing the financial risk for landowners who

Crop producers and bioenergy producers will be able to team up to develop applications to USDA to be selected as a BCAP project area.

Producers will be eligible for reimbursements of up to 75 percent of the cost of establishing a bioenergy perennial crop. Producers also can receive up to 3 years of annual payments for grassy crops (annual or perennial), and up to 15 years for woody crops (perennial).

Assistance for the collection, harvest, storage and transportation of biomass will be available for 2 years, per producer, in the form of a matching payment for up to \$150,000 per acre for a collection facility.

Highlights

During the Notice of Funding period, \$250 million and during roughly one quarter year of BCAP matching payments. Refinements to the BCAP final rule has the BCAP cost-benefit analysis estimating that total expenditures over 15 years will be \$461 million.

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New Energy Crop Feedstocks

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Eligibility and Measures

1. Under BCAP, biomass must be certified to have been collected only with conservation, forest stewardship, or similar plan to protect soil and water quality and preserve land productivity into the future.
 2. Harvesting must occur with an approved harvest plan.
 3. BCAP project areas cannot be on native soil.
- crop collection, harvesting, and transportation must be in strict accordance with invasive plant species protection.

Protects existing markets

Eligible materials may not qualify for matching payments for BCAP purposes if USDA determines that in those distinct localities that the materials are used for pre-existing markets.

Prairie State Biomass team

~24 farmers:

- Prairie State Biomass Producers Association, chaired by Eric Rund of Pesotum, IL, and including including Omni-Ventures group from western Illinois.

Three committed biomass conversion facilities:

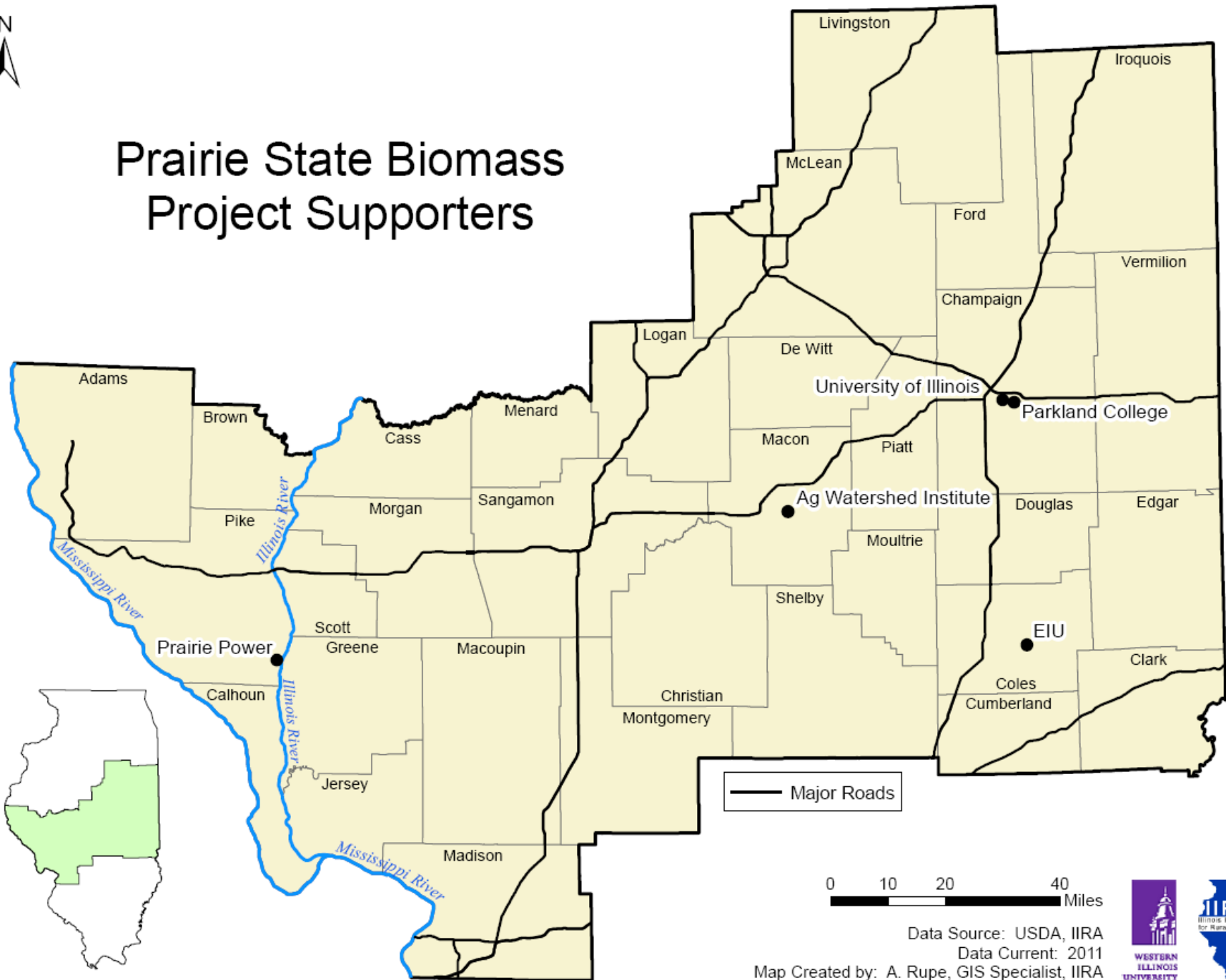
- Prairie Power, Inc.
- Parkland College
- Ag Watershed Institute, Community Supported Energy network

Two supporting biomass conversion facilities:

- University of Illinois at Urbana-Champaign
- Eastern Illinois University



Prairie State Biomass Project Supporters



0 10 20 40
Miles

Data Source: USDA, IIRA

Data Current: 2011

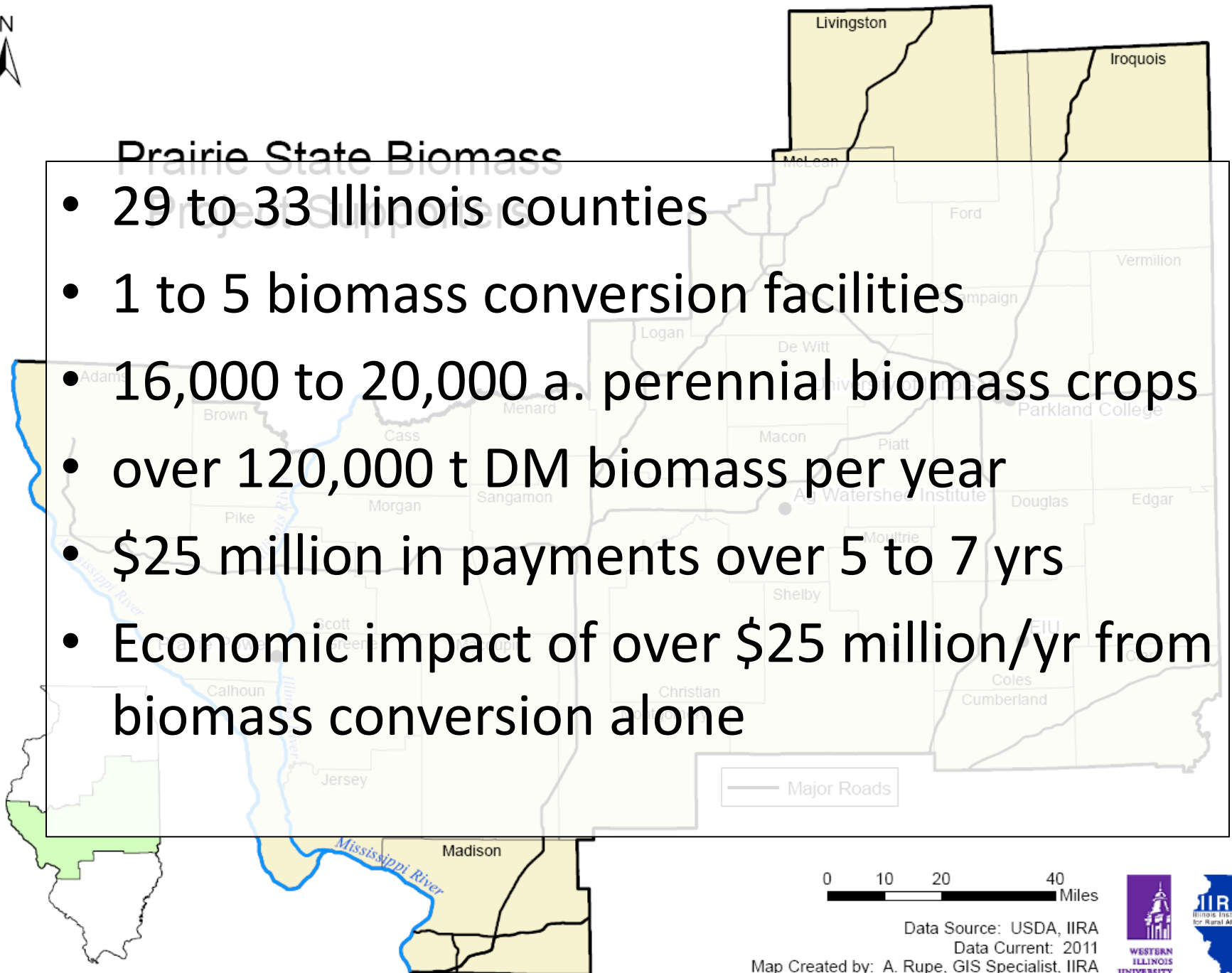
Map Created by: A. Rupe, GIS Specialist, IIRA





Prairie State Biomass

- 29 to 33 Illinois counties
- 1 to 5 biomass conversion facilities
- 16,000 to 20,000 a. perennial biomass crops
- over 120,000 t DM biomass per year
- \$25 million in payments over 5 to 7 yrs
- Economic impact of over \$25 million/yr from biomass conversion alone



0 10 20 40
Miles

Data Source: USDA, IIRA
Data Current: 2011

Map Created by: A. Rupe, GIS Specialist, IIRA



Prairie State Biomass Project Area

- Potential to jump-start biomass market in Illinois...
- ...but needed to jump to make the application deadline.



Prairie State Biomass Project Area



Ray Spencer



Heather Fox

Not pictured:
Josh Birky
Jill Garner

- Support team included Land Grant, 4-yr non-Land Grant, and community college personnel.
- Parkland Grants & Contracts Office played keystone role

A group of people, mostly young adults, are seated at long tables covered with white cloths in a large, rustic hall with a high wooden-beamed ceiling. They are facing a presentation screen at the front of the room. A person in a blue shirt is standing near the screen, possibly presenting. The room is filled with various items on shelves in the background, including a spare tire and some equipment. The text "Opportunities for teaching" is overlaid in large white font across the center of the image.

Opportunities for teaching

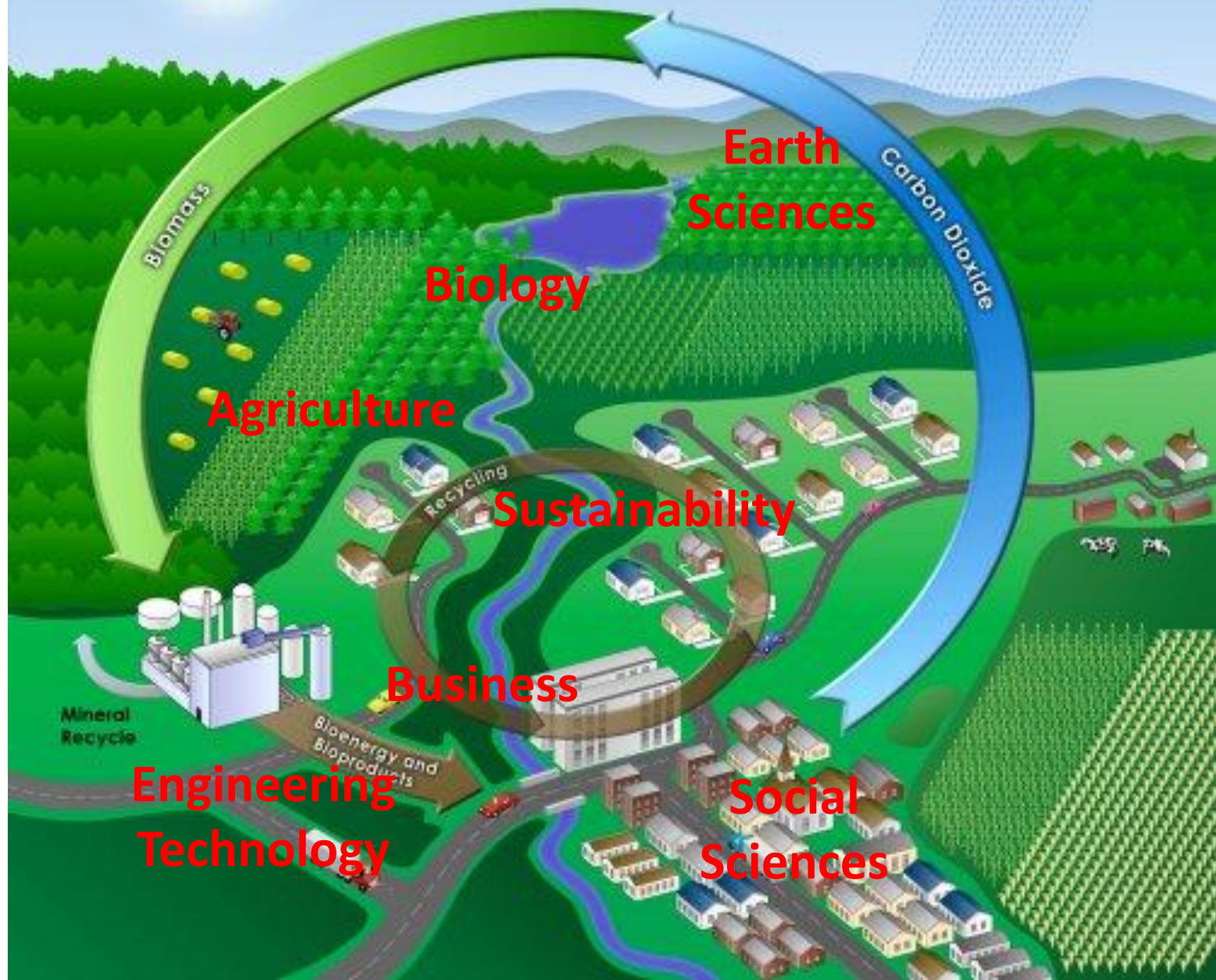
More on Mount Wachusett...

- Leveraged biomass project into new Renewable Energy degree program



...but biomass can fit many places in the curriculum:

Biomass energy in the curriculum



Introduction to Biofuels - Mozilla Firefox

File Edit View History Bookmarks Tools Help

Introduction to Biofuels

www.agrowknow.org/introduction-to-biofuels.html


Agrow Knowledge

The National Resource Center for Agriscience & Technology Education

Home About AgrowKnowledge Resource Clearinghouse Career Clusters Events Special Projects Membership

Food Products & Processing Plant Animal Power, Structural & Technical Natural Resource Environmental

Introduction to Biofuels



Note that only the first topic is available to non-members. If you wish to have access to the full "Introduction to Biofuels" course, please consider becoming a [member of AgrowKnowledge](#).

[View the syllabus](#)

Topical Outline for the Course

Week	Classroom Lecture	Lab	Due
1	Topic 1. Carbon in Our Environment Topic 2. Introduction to Biofuels (members only) LAB 1	1 Carbon Footprint	
2	Topic 3. Combustion Engines (members only) Part 1. Parts and Function Topic 3. Combustion Engines Part 2. Turbines and Fuel Ratings LAB 2	2 Combustion Engines	Quiz 1 Carbon and Introduction to Biofuels Worksheet 1 Chemistry of Petroleum
3	Topic 4. Alcohol Fuels (members only) Part 1. Attributes and History Topic 4. Alcohol Fuels Part 2. Characteristics LAB 3	3 Energy Value of Fuels	Quiz 2 Combustion Engines
4	Topic 4. Alcohol Fuels Part 3. Ethanol Production		Quiz 3 Alcohol Fuel Attributes and Characteristics

[Login/Register](#)

Hi, flutzi [Log out](#)

Calendar

October 2011

Sun	Mon	Tue	Wed	Thu	Fri	Sat
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31					

My Account

- [Current Membership](#)
- [User Information](#)
- [Membership Plans](#)

AgrowKnowledge on the Web

[YouTube](#)

[About AgrowKnowledge](#)

http://www.agrowknow.org/

AgroKnowledge biofuels curriculum

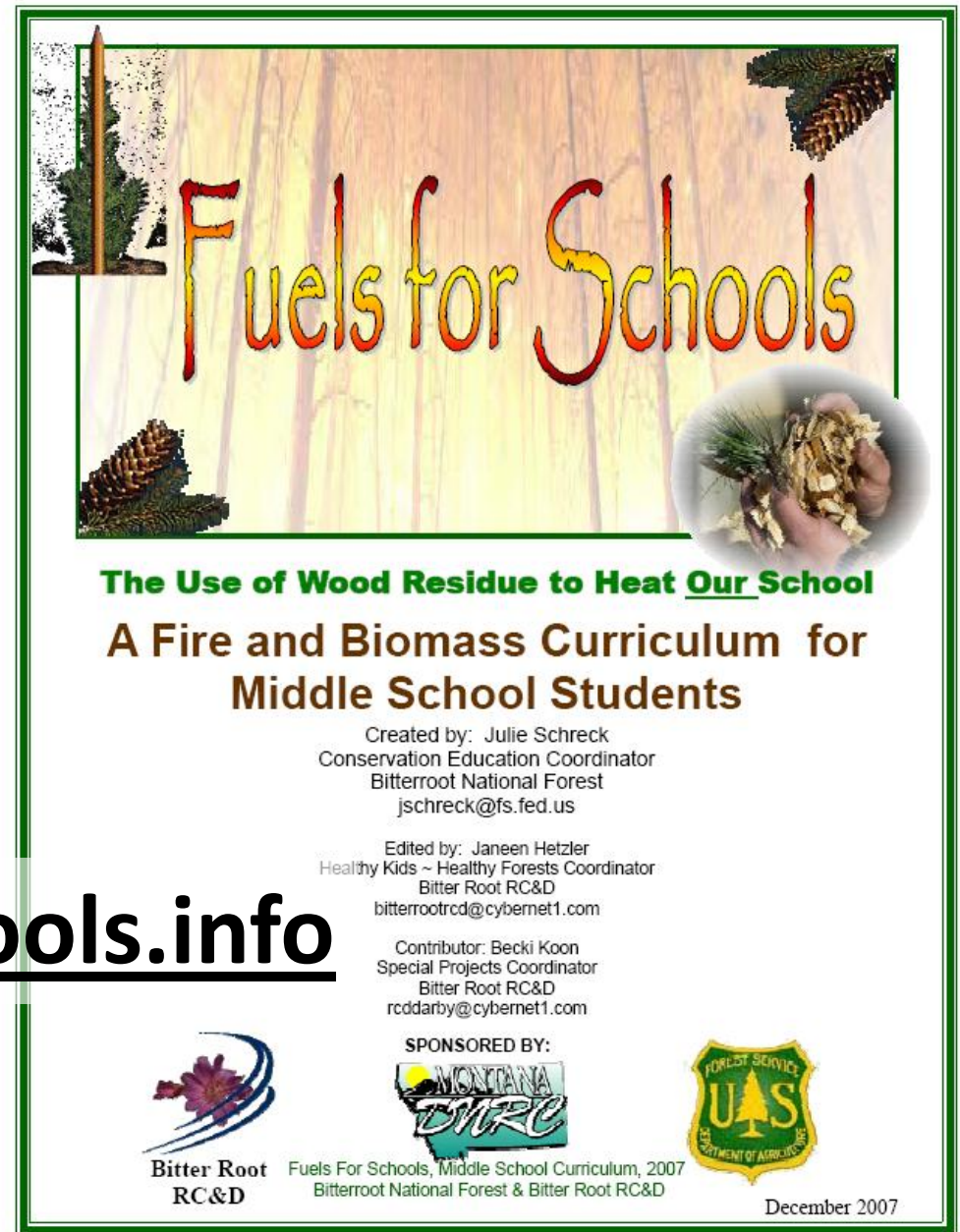
- Designed for college
- Includes unit on biomass gasification
- Paid subscription required.

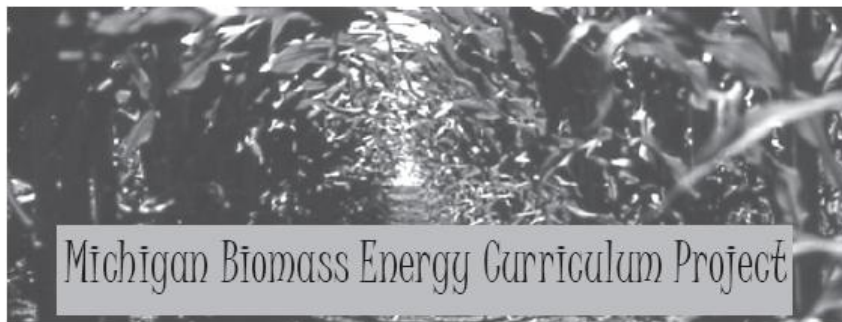
www.AgroKnow.org

USFS Biomass Curriculum

- Developed for middle school; possible to adapt?

www.FuelsforSchools.info





Funded by:
U.S. Department of Energy
www.energy.gov

Administered by:
Michigan Department of Labor and Economic Growth: Energy Office
<http://www.michigan.gov/cis>

Created by:
Michigan Association of Conservation Districts, 2005
www.macd.org

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Niles High School
Muskegon Conservation District
Calhoun Conservation District

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Dulcey Simpkins
Christy Roman
Teresa Salveta
Greg Mund

Olivet College
Energy Office
MACD
MACD
USDA-NRCS



Michigan Biomass Curriculum

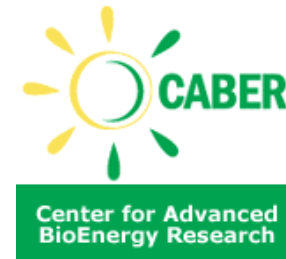
- Developed for K-12; possible to adapt?

<http://tinyurl.com/MIBiomassCurriculum>



Linking farmers, businesses, researchers, and agencies to accelerate development of a sustainable, profitable biomass energy sector in Illinois.

Participating institutions include:



CHIP ENERGY
CLEAN RENEWABLE FUEL



PRAIRIE
POWER INC.
A Touchstone Energy® Cooperative



IBWG's biomass to-do list:

- Link existing and potential buyers and sellers; help create complete biomass supply chains.



IBWG's biomass to-do list:



FACT SHEET

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Highlights

Expenditures

During the Notice of Funding Availability (NOFA) period, \$250 million was expended during

impact from implementation to be an estimated \$88.5 billion in economic activity.

• Keep producers & end users informed of key incentives; help policymakers assess needs and impacts.

- * Enhanced stewardship and conservation requirements. 1. Under BCAP, biomass must be certified to have been collected and harvested only with an approved conservation, forest stewardship, or similar plan to protect soil and water quality and preserve land productivity into the future. 2. Harvesting must occur with an approved harvest plan. 3. BCAP project areas cannot occur on native sod. 4. All crop collection, harvesting, and transportation must be in strict accordance with invasive plant species protection.

IBWG's biomass to-do list:

- Benchmark existing technologies & feedstocks and work toward standard specifications.



UIUC



Metro Planning Council

- Create dialogue to help regulatory processes be effective & efficient for all parties.

IBWG's biomass to-do list:

- Document the development of the biomass industry in Illinois.



www.IllinoisBiomass.org

Illinois Biomass Facility Profiles
Eastern Illinois University
Renewable Energy Center
Charleston, IL

Facility facts

Owner: Eastern Illinois University,
Charleston, IL.

Status: Under construction.

(Owner estimates startup in April
2011.)

Output: Steam for district heating
& cooling, with secondary electrical
generation.

Feedstock: 100% virgin wood
chips initially

Platform: Gasification.

Information current as of: Nov. 15, 2010



EIU graphic

Facility Profile

Faced with the need to replace a 19xx-vintage coal-fired heating plant nearing the end of its lifespan, EIU is building a new facility powered by biomass. When it comes online in 2011, the EIU Renewable Energy Center will supply 100% of campus heating and cooling needs using two boilers fired by a Chiptec biomass gasifier. The facility will include a 685 kW steam turbine for electrical co-generation and a backup natural gas / fuel oil system. EIU intends initially to operate the facility using some 27,000 t DM/yr of virgin wood chips, but is interested in other feedstock options for the future, including perennial grass crops and corn stover. The university has entered into an innovative \$80 million energy performance contract with Honeywell International to build the plant, in a package that includes over a dozen other green energy measures.

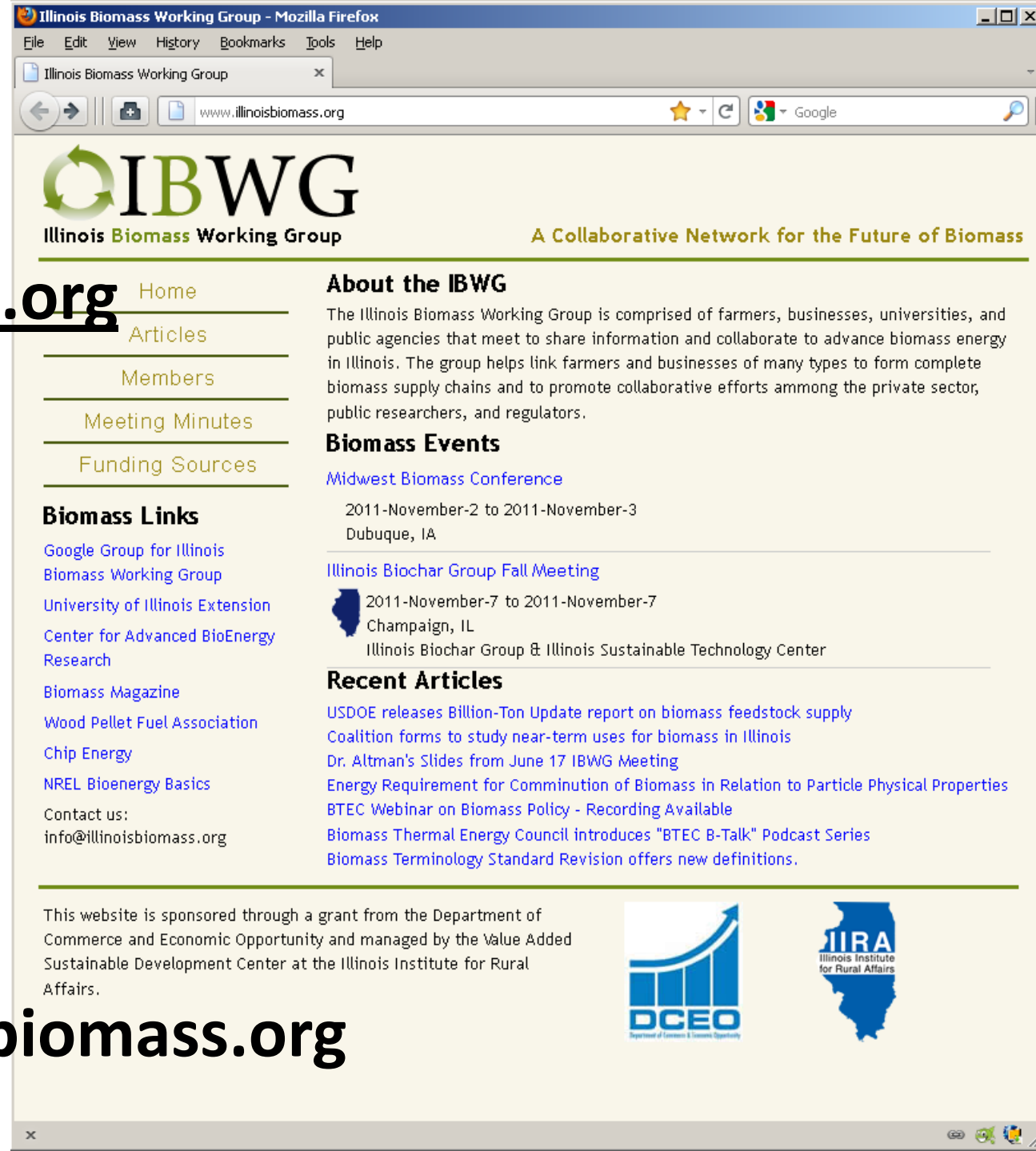
Website

IllinoisBiomass.org

Email list

Contact:

info@illinoisbiomass.org



The screenshot shows a Mozilla Firefox browser window displaying the Illinois Biomass Working Group (IBWG) website. The browser's address bar shows the URL www.illinoisbiomass.org. The website has a yellow background and features the IBWG logo at the top, which consists of a green circular arrow icon and the text "IBWG". Below the logo, the text "Illinois Biomass Working Group" and "A Collaborative Network for the Future of Biomass" are displayed. The website is organized into several sections: a left sidebar with links to Home, Articles, Members, Meeting Minutes, and Funding Sources; a main content area with sections for Biomass Links, Biomass Events, and Recent Articles; and a footer with sponsorship information and logos for the Department of Commerce and Economic Opportunity (DCEO) and the Illinois Institute for Rural Affairs (IIRA).

Illinois Biomass Working Group
A Collaborative Network for the Future of Biomass

Home
Articles
Members
Meeting Minutes
Funding Sources

Biomass Links
[Google Group for Illinois Biomass Working Group](#)
[University of Illinois Extension Center for Advanced BioEnergy Research](#)
[Biomass Magazine](#)
[Wood Pellet Fuel Association](#)
[Chip Energy](#)
[NREL Bioenergy Basics](#)
Contact us:
info@illinoisbiomass.org

About the IBWG
The Illinois Biomass Working Group is comprised of farmers, businesses, universities, and public agencies that meet to share information and collaborate to advance biomass energy in Illinois. The group helps link farmers and businesses of many types to form complete biomass supply chains and to promote collaborative efforts among the private sector, public researchers, and regulators.

Biomass Events
Midwest Biomass Conference
2011-November-2 to 2011-November-3
Dubuque, IA

Illinois Biochar Group Fall Meeting
2011-November-7 to 2011-November-7
Champaign, IL
Illinois Biochar Group & Illinois Sustainable Technology Center

Recent Articles
[USDOE releases Billion-Ton Update report on biomass feedstock supply](#)
[Coalition forms to study near-term uses for biomass in Illinois](#)
[Dr. Altman's Slides from June 17 IBWG Meeting](#)
[Energy Requirement for Comminution of Biomass in Relation to Particle Physical Properties](#)
[BTEC Webinar on Biomass Policy - Recording Available](#)
[Biomass Thermal Energy Council introduces "BTEC B-Talk" Podcast Series](#)
[Biomass Terminology Standard Revision offers new definitions.](#)

This website is sponsored through a grant from the Department of Commerce and Economic Opportunity and managed by the Value Added Sustainable Development Center at the Illinois Institute for Rural Affairs.

DCEO
Department of Commerce & Economic Opportunity

IIRA
Illinois Institute for Rural Affairs

Grant opportunities

DCEO Renewable Energy Grant Portal
provided by IIRA:

IllinoisWind.org/DCEOPortal/

IllinoisWind.org - Mozilla Firefox

File Edit View History Bookmarks Tools Help

IllinoisWind.org x

www.illinoiswind.org/DCEOPortal/ Google



A project of the Illinois Institute for Rural Affairs

Home About Us Wind Monitoring Program Resource Maps Online Resources Publications Small Wind Toolbox Links DCEO Grant Portal



DCEO Renewable Energy Grant Portal

Welcome to the DCEO Renewable Energy Grant Portal, hosted by the Illinois Institute for Rural Affairs at Western Illinois University.

The Illinois Department of Commerce and Economic Opportunity (DCEO) works to improve Illinois' competitiveness in the global economy, create and retain high quality jobs, and build strong communities. Within DCEO the Illinois Energy Office administers programs in renewable energy, renewable fuels, energy efficiency, and recycling. This website is designed to allow renewable energy grant seekers to quickly find the appropriate DCEO program for their needs, research complementary grants from other funders, and access the technical information and resources needed to make their grant project a success.

Please start by selecting a renewable energy sector below.



			
<u>Wind</u>	<u>Solar</u>	<u>Biomass</u>	<u>Bioogas</u>



WESTERN
ILLINOIS
UNIVERSITY

Illinois Institute for Rural Affairs
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